



Generation Interconnections

This analysis was completed to assess the reliability impact for a new generator interconnecting to the PJM system as a capacity resource.

Network Impacts - 500 MW Injection

Network impacts for the injection of 500 MW into the Pericktown 230kV Substation are as follows:

During normal operation, with all transmission facilities in-service, power flow simulation indicates that all voltages can be adjusted within an acceptable range but the following transmission line thermal overloads were found: (The overload of these facilities may not be solely due to the addition of this generator. MVA values listed are this project's approximate contribution to the overload)

69kV

- Mickleton-Mantua 69 kV line; 10MVA
- Mantua-Wenonah-Pitman 69 kV; 10MVA

138 kV

- Cuthbert - Gloucester; 30 MVA

230 kV

- Mickleton-Trainer-Chichester 230 kV circuit; 230 MVA
- Mickleton-Monroe 230 kV line; 70 MVA
- Master - N. Phila. (220-44 line); 30 MVA
- N. Phila. - Waneeta (220-49 line); 15 MVA
- Grays Ferry - Parrish (220-27 line); 55 MVA
- Master - Parrish (220-45 line); 30 MVA
- Gloucester - Eagle Point (P2242 line); 90 MVA
- Gloucester 230/138kV transformer; 30 MVA

Single contingency and towerline outage analyses were also performed. The following facilities were found to exceed emergency ratings for single contingency outages: (The overload of these facilities may not be solely due to the addition of this generator. MVA

values listed are this project's approximate contribution to the overload)

69 kV

- Monroe - Central, (72/89 N/E), 3% over emergency rating for loss of Cumberland - Churchtown 230kV.

138 kV

- Cuthbert - Gloucester; 30 MV

230 kV

- Mickleton-Trainer- Chichester 230 kV; 230 MVA
- Mickleton-Monroe 230 kV; 70 MVA
- Master - N. Phila. (220-44 line); 30 MVA
- N. Phila. - Waneeta (220-49 line); 15 MVA
- Grays Ferry - Parrish (220-27 line); 55 MVA
- Master - Parrish (220-45 line); 30 MVA
- Gloucester - Eagle Point (P2242 line); 90 MVA
- Gloucester 230/138kV transformer; 30 MVA
- Churchtown 230/69 kV transformer, (226/258 N/E); 8% over emergency rating for loss of Cumberland-Churchtown 230 kV.
- Mickleton-Bridgeport 230 kV, (643/755 N/E); 31% over emergency rating for loss of Chambers-Churchtown 230 kV.
- Chambers-Churchtown 230 kV, (643/755 N/E); 39% over emergency rating for loss of Mickleton-Bridgeport 230 kV.

500 kV

- Conastone 500/230kV transformer; 15 MVA

(Note: All normal operation and contingency overloads shown for local and regional system impacts may not be solely due to the injection of 500 MW by this project. In some instances this project aggravates an overload which exists from injection of generation which was earlier in Queue A).

The cost and construction time estimates for required network upgrades are as follows:

69 kV Upgrades

- Upgrade the Mantua-Wenonah-Pitman 69 kV line to 1200 A. normal rating. (\$1M)
- Upgrade the Mickleton - Mantua 69 kV line to 1600 A normal rating. (\$0.6M)
- Upgrade Monroe - Central (\$0.2M)

138 kV Upgrades

- Cuthbert Blvd - Gloucester; \$25M
The transmission reinforcements needed to alleviate the Gloucester - Cuthbert Blvd overload include conversion of the Cuthbert Boulevard-Camden 138 kV cable circuit to 230kV operation, installation of a Phase Angle Regulator in this circuit, terminal facilities at Gloucester and Camden, and conversion of the Cuthbert Boulevard Substation to 230 kV. The estimated costs for these facilities are \$15.0 million for station work and \$10.0 million for the replacement of the 138 kV cable with 230 kV cable. The Phase Angle Regulator in this circuit will be needed to control the contingency loading of one Eagle Point Gloucester 230 kV circuit for the loss of the other Eagle Point Gloucester 230 kV circuit.

230 kV Upgrades

- #2 Mickleton-Monroe 230 kV. (Substation: \$5.4M; Line: \$2.1M)
- Upgrade Mickleton-Trainer-Chichester 230 kV circuit. (\$6.5M to 12M)
- Churchtown-D/W 230/138 kV transformer and line to D/W 138 kV. (Substation: \$5.5M; Line: \$0.5M)
- Grays Ferry - Parrish 230 kV (220-27 line); \$10 Million
- Master - N. Philadelphia 230 kV (220-44 line); \$8 Million
- N. Philadelphia - Waneeta 230 kV (220-49 line); \$6 Million
- Master - Parrish (220-45 line); \$4 Million
- Gloucester - Eagle Point (P2242 line); \$5 Million
- Gloucester 230/138kV transformer; (This overload is alleviated by the 138kV Cuthbert Blvd - Gloucester upgrade shown above)

500 kV Upgrades

- Conastone 500/230kV transformer; \$20M

Estimated time for construction of upgrades is 24-36 months assuming that it is possible to concurrently perform all of the work and obtain the required outages to transmission facilities.

A short circuit analysis was not performed for this project because the results will be highly dependent upon assumptions about connection of nearby projects which are earlier in Generator Interconnection Request Queue A. Many 230 kV circuit breakers in this area of the transmission system may become overdutied and require replacement if several new generators connect. A 230 kV circuit breaker replacement is estimated to cost \$350,000 and take 12-18 months to complete. Replacing multiple circuit breakers can take longer if facility outages can not be obtained to allow for work to be performed concurrently.